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Case Report

Pneumococcal endocarditis complicating meningitis and arthritis in a previously healthy woman: A case report

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ABSTRACT

Streptococcus pneumoniae is the most common cause of community-acquired bacterial meningitis in adults. Pneumococcal endocarditis coexisting with meningitis is rare, especially in healthy individuals. A 66-year-old woman was admitted with pneumococcal bacteremia, meningitis, and arthritis. She was in good condition before admission. Because of typical presentation of bacterial meningitis characteristics and normal echocardiographic findings, the patient was administered antibiotics for meningitis and arthritis. On hospitalization day 59, she developed a fever, and echocardiography showed severe aortic regurgitation, perforation, and vegetation of the aortic valve. She was diagnosed with pneumococcal endocarditis and underwent aortic valve replacement surgery. In general, invasive pneumococcal infections occur in debilitated middle-aged men with predisposing factors such as chronic alcoholism, chronic obstructive pulmonary disease, and immunosuppressive conditions. In this case, regardless of the appropriate treatment and no risk of invasive pneumococcal infections, infective endocarditis occurred.

<**Learning objective:** This case suggested that invasive pneumococcal infections progressing to infective endocarditis can occur in healthy individuals and underscore the importance of careful observation in patients with pneumococcal meningitis, in particular, in the case of blood culture positive patients.>

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Introduction

Streptococcus pneumoniae is a rare cause of infective endocarditis (IE) in the post-antibiotic era, accounting for <1% of all cases in native valves [1]. Middle-aged men are at a high risk of invasive pneumococcal infections such as pneumococcal endocarditis, and predisposing factors include chronic alcoholism, congestive heart failure, current smoking, chronic obstructive pulmonary disease, immunosuppressive conditions, asplenia, and ear or sinus infection [1,2]. Pneumococcal endocarditis often runs a fulminant course and is associated with rapid valvular destruction and/or systemic embolism. Therefore, early diagnosis and appropriate treatment are important to reduce the incidence of complications. We present a case of invasive pneumococcal infection in a previously healthy woman that was complicated by progression to aortic valve destruction despite adequate antibiotic therapy.

Case report

A 66-year-old woman with no pre-existing conditions presented to the orthopedic department of our hospital with a 4-day history of right knee pain. In the waiting room, she suddenly became confused and could not communicate. She was referred to a neurologist and was admitted with a diagnosis of bacterial meningitis based on cerebrospinal fluid (CSF) findings (white blood

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cell (WBC) 1214 μL^{-1}, granulocytes 1211 μL^{-1}, glucose below lower limit of detection and protein 558 mg/dL).

On examination, her body temperature was 35.8 °C, blood pressure was 110/60 (77) mmHg, heart rate was 84 beats/min, and percutaneous oxygen saturation was 98% (room air). Physical findings were not consistent with meningitis and IE. Blood test results showed that the WBC count was 8.27×10^3 μL^{-1}, the red blood cell (RBC) count was 4.02×10^6 μL^{-1}, the platelet count was 176×10^3 μL^{-1}, and C-reactive protein (CRP) level was 38.9 mg/dL. Pneumococcal urine antigen test results were negative. She was treated with meropenem (2 g three times a day) and vancomycin (0.5 g three times a day) by intravenous drip infusion. Transthoracic echocardiography (TTE) performed on day 2 showed no signs of valve disease and vegetation. On day 4, the patient underwent arthroscopic right knee debridement. The right knee joint fluid culture, two sets of blood cultures and CSF culture on admission grew penicillin-intermediate-sensitive *S. pneumoniae* (minimum inhibitory concentration, 0.5 μg/mL). Based on the results of drug susceptibility assays, vancomycin was discontinued on day 5. The CSF findings were improved (WBC 98 μL^{-1}, granulocytes 18 μL^{-1}, glucose 52 mg/dL, protein 75 mg/dL); CSF culture and two sets of blood cultures were negative on day 6. On day 18, the patient developed a low-grade fever, rash, and eosinophilia, and drug fever was suspected. Meropenem was exchanged for ceftriaxone (2 g twice a day), which was administered until day 21.

Two days after cessation of antibiotic therapy, the patient developed a fever (temperature 39.1 °C) and lower back pain. She was suspected to have sacroiliac arthritis based on the findings of magnetic resonance imaging (MRI) and was treated with levofloxacin (500 mg once a day oral). The two sets of blood cultures were sterile at this time. She was immediately given an antipyretic and the lower back pain improved. But a high inflammatory response persisted (CRP 7.09 mg/dL).

On day 59, a grade 3/6 to-and-fro murmur was heard at the aortic valve area and the patient was referred to a cardiologist. The results of TTE and transesophageal echocardiography indicated perforation of the noncoronary cusp of the aortic valve and vegetation measuring 4 mm in length. Severe aortic regurgitation was detected (Fig. 1). There was no evidence of an aortic-root abscess, and the aortic root was not dilated. Left ventricular end-diastolic dimension was 61 mm and end-systolic dimension was 40 mm. Estimated systolic pulmonary arterial pressure was 59 mmHg. On examination, body temperature was 36.0 °C, blood pressure was 91/41 (55) mmHg, heart rate was 75 beats/min, and percutaneous oxygen saturation was 97% (room air). No subjective symptoms of heart failure or embolic signs were observed. Chest radiography showed an enlarged cardiac silhouette and congestion. Blood test results showed that the WBC count was 7.21×10^3 μL^{-1} (granulocytes 3.55×10^3 μL^{-1}, lymphocytes 2.56×10^3 μL^{-1}), the RBC count was 2.88×10^6 μL^{-1}, the platelet count was 257×10^3 μL^{-1}, CRP level was 4.92 mg/dL, B-type natriuretic peptide 579 pg/mL, no immune abnormalities (IgG 1272 mg/dL, IgA 109 mg/dL, IgM 101 mg/dL, C3 118 mg/dL, C4 22.3 mg/dL, CH50 52.0) and no human immunodeficiency virus infection. The two sets of blood cultures were negative at this time, too. Brain MRI and magnetic resonance angiography showed no evidence of stroke or intracranial or carotid artery aneurysms. She was diagnosed with pneumococcal endocarditis, and ceftriaxone (2 g once a day) treatment was resumed by intravenous drip infusion. Because of decompensated heart failure resulting from aortic valve destruction, she underwent aortic valve replacement surgery 4 days after diagnosis of IE (Fig. 2). Intraoperative findings revealed perforation of the noncoronary cusp and vegetation. Histopathological findings showed inflammatory cell infiltration in the noncoronary cusp, although bacterial cells were not detected (Fig. 3).

She was administered ceftriaxone (2 g twice a day) for 14 days after surgery. (Total antibiotic administration period was 8 weeks after confirming the blood cultures negative.) Her postoperative course was uneventful, there was no recurrence of infection after cessation of antibiotic therapy, and she was discharged 30 days after surgery.

Discussion

S. pneumoniae is a Gram-positive coccus with a global presentation. Invasive pneumococcal infections are defined as infections confirmed by the isolation of *S. pneumoniae* from a normally sterile site such as blood, CSF, and articular cavities. Bacteremia may cause secondary complications such as arthritis, meningitis, and endocarditis. *S. pneumoniae* is the most common cause of community-acquired pneumonia and bacterial meningitis in adults. However, it is not a common cause of IE in the post-antibiotic era [1,3–5]. In a prospective, multicenter, international, observational study of hospitalized patients with *S. pneumoniae* bacteremia, only five of 844 (0.6%) patients developed endocarditis [6].

Bacterial meningitis and IE are rarely found as coexisting conditions. Bacterial meningitis is present in approximately 1–7% of all IE patients [3] and IE is identified in 2% of bacterial meningitis patients [4]. However, the mortality rate associated with the coexistence of meningitis and endocarditis is high (29–63%) [4,7]. The most common causative pathogens in patients with both

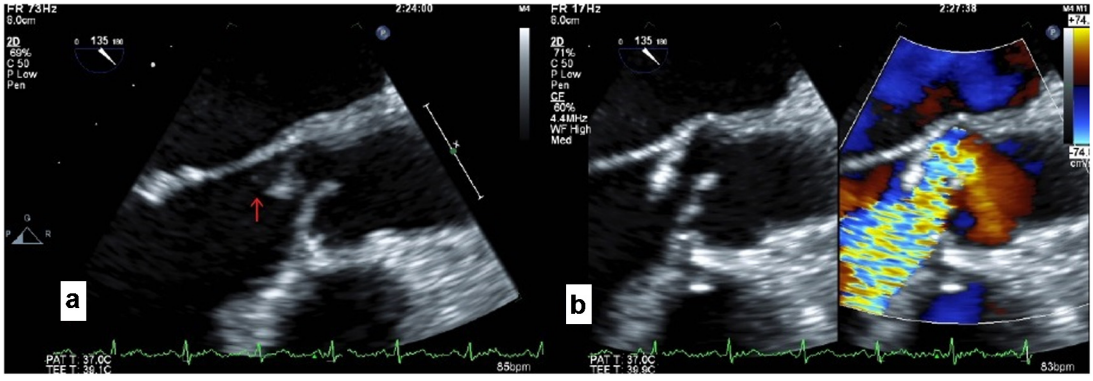

Fig. 1. Transesophageal echocardiography. (a) Mid-esophageal long-axis view showing vegetation (arrow) of the noncoronary cusp. (b) Mid-esophageal long-axis color compares views showing perforation of the noncoronary cusp and severe aortic regurgitation.

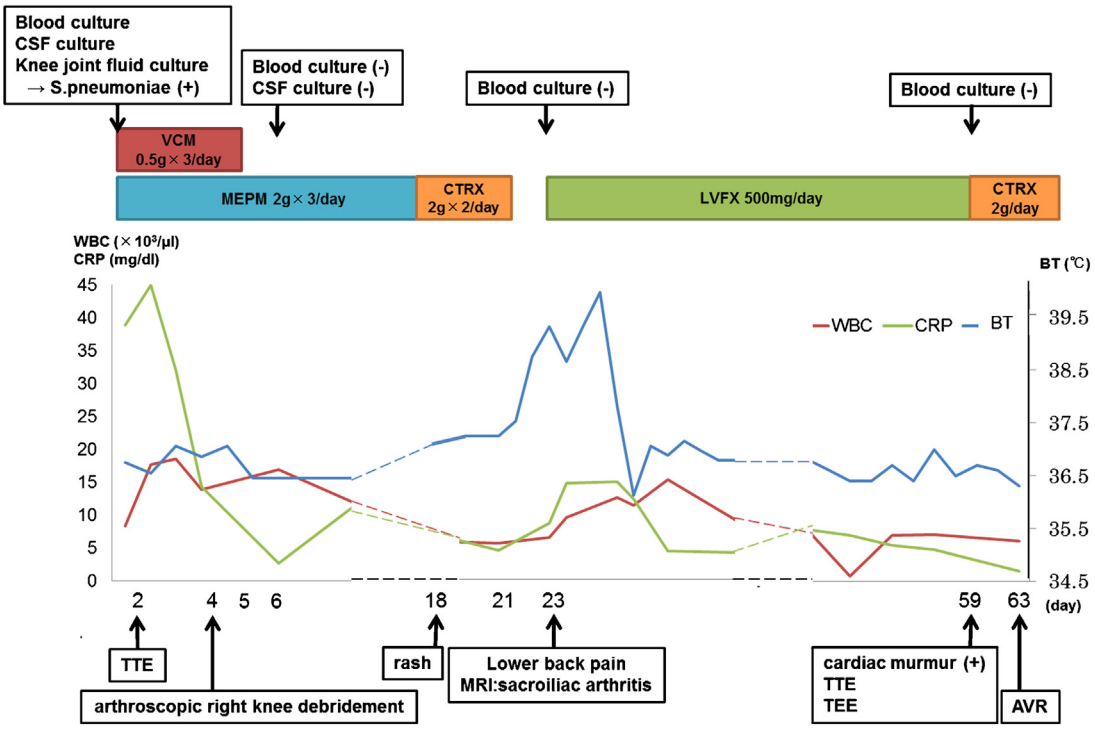

Fig. 2. Clinical course after admission. The right knee joint fluid culture, two sets of blood cultures and CSF culture on admission grew penicillin-intermediate-sensitive *Streptococcus pneumonia*. All culture results were negative after antibiotic therapy. Transthoracic echocardiography (TTE) performed on day 2 showed no signs of valve disease and vegetation, but the results of TTE on day 59 showed perforation of severe aortic valve regurgitation and vegetation. CSF, cerebrospinal fluid; WBC, white blood cell; CRP, C-reactive protein; BT, body temperature; MRI, magnetic resonance image; TTE, transthoracic echocardiography; TEE, transesophageal echocardiography; AVR, aortic valve replacement; VCM, vancomycin; MEPM, meropenem; CTRX, ceftriaxone; LVFX, levofloxacin.

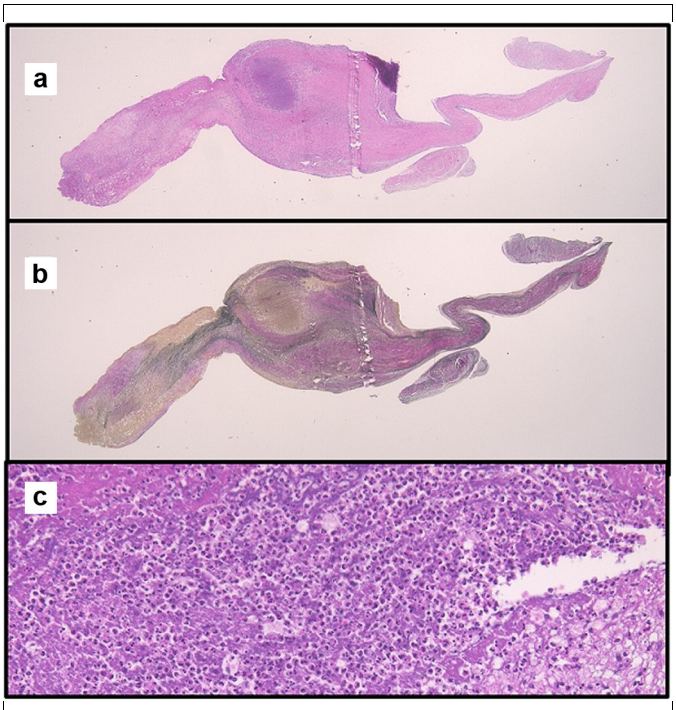

Fig. 3. Pathological findings of the noncoronary cusp. (a and b) Low-power (original magnification 10×) microphotograph showing tissue destruction in the valve as observed after Elastica van Gieson staining. (c) High-power (original magnification 400×) microphotograph showing healed infective endocarditis, non-specific inflammatory cell infiltration, and no bacteria according to the results of hematoxylin and eosin staining.

IE and bacterial meningitis are *S. pneumoniae* and *Staphylococcus aureus* [4]. A previous study showed that endocarditis caused by *S. aureus* is commonly the primary infection focus, and pneumococcal endocarditis is a complication of meningitis [8]. Pneumococcal meningitis often presents with the typical clinical and CSF characteristics of bacterial meningitis; therefore, pneumococcal endocarditis is generally detected after development of complications [4].

Despite adequate antibiotic therapy, the progression of pneumococcal endocarditis is usually acute and aggressive, with a high rate of local and systemic complications such as embolic stroke and heart failure [5]. Infection may occur in a morphologically and functionally normal valve, and the native aortic valve is the most frequent localization of vegetation and destruction [2,5]. The recommended antibiotic treatment duration is 10–14 days in patients with meningitis and 14 days in patients with arthritis. However, the duration of antibiotic treatment in patients complicated with endocarditis is 4–6 weeks [9], and patients with heart failure, uncontrolled infection, or those at risk of embolic events may require cardiac surgery.

Most invasive pneumococcal infections occur in debilitated middle-aged men with predisposing factors such as chronic alcoholism, congestive heart failure, current smoking, chronic obstructive pulmonary disease, immunosuppressive conditions, and ear or sinus infection [1,2].

Our case had not been evaluated for IE based on the modified Duke criteria [10] before examination by a cardiologist. Therefore, the timing of aortic valve destruction and vegetation development is not known. The fact that the left ventricle was dilated when IE was diagnosed suggests that severe aortic regurgitation developed early in the course of pneumococcal infection. The findings of the present study indicate that invasive pneumococcal infections progressing to IE can develop in healthy individuals and

underscore the importance of careful observation in patients with pneumococcal meningitis, especially in the case of blood culture positive patients.

Conflict of interest

The authors state that they have no conflict of interest.

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